



(12) **United States Patent**
Johnson et al.

(10) **Patent No.:** **US 10,614,775 B2**
(45) **Date of Patent:** **Apr. 7, 2020**

(54) **ELECTRONIC DEVICES HAVING BACKLIT KEYBOARDS DISPLAYS WITH ADJUSTABLE WHITE POINTS**

(2013.01); *G06F 1/1681* (2013.01); *G09G 2320/062* (2013.01); *G09G 2320/0666* (2013.01); *G09G 2360/144* (2013.01)

(71) Applicant: **Apple Inc.**, Cupertino, CA (US)

(58) **Field of Classification Search**

CPC *G06F 1/1616*; *G06F 1/165*; *G06F 1/1662*; *G06F 1/1692*; *G09G 2320/0666*; *G09G 2360/144*

See application file for complete search history.

(72) Inventors: **Paul V. Johnson**, San Francisco, CA (US); **Lu Zhang**, Campbell, CA (US); **Jiaying Wu**, San Jose, CA (US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(56) **References Cited**

U.S. PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

7,019,736 B2 3/2006 Allen et al.
8,915,633 B2 12/2014 Pance et al.
9,557,473 B2 1/2017 Nichol et al.
9,947,275 B1* 4/2018 Ramanath *G09G 3/3413*
(Continued)

(21) Appl. No.: **15/979,315**

(22) Filed: **May 14, 2018**

Primary Examiner — Michael Pervan

(65) **Prior Publication Data**

US 2019/0051267 A1 Feb. 14, 2019

(74) *Attorney, Agent, or Firm* — Treyz Law Group, P.C.; G. Victor Treyz; David K. Cole

Related U.S. Application Data

(57) **ABSTRACT**

(60) Provisional application No. 62/542,727, filed on Aug. 8, 2017.

An electronic device may have a main display and an ancillary display that forms a dynamic function row. The device may also have a backlit keyboard with glyphs. The keyboard may have light-emitting diodes that emit backlight illumination. The backlight illumination has a backlight illumination color and intensity. A color ambient light sensor may measure ambient light color and intensity. Control circuitry in the laptop computer may make white point adjustments to the main and ancillary displays. White point adjustments may be made based on factors such as the backlight illumination intensity, information on the nominal white point of a display (which may be comparable to the color of the backlight illumination), information on the ambient light color and intensity, and a white point adaptation scaling factor.

(51) **Int. Cl.**

G06F 1/16 (2006.01)
G09G 5/02 (2006.01)
G06F 3/02 (2006.01)
G06F 3/14 (2006.01)
G09G 3/34 (2006.01)
G09G 5/00 (2006.01)

(52) **U.S. Cl.**

CPC *G09G 5/02* (2013.01); *G06F 1/165* (2013.01); *G06F 1/1616* (2013.01); *G06F 1/1662* (2013.01); *G06F 1/1692* (2013.01); *G06F 3/0202* (2013.01); *G06F 3/1423* (2013.01); *G09G 3/34* (2013.01); *G09G 5/003*

18 Claims, 5 Drawing Sheets

